ORT Business Rules

V2.2

Prepared For

New Hampshire Department of Transportation
Bureau of Turnpikes
Contract # 2010-007
Hampton Open Road Tolling System

By

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Date	Version	Description	Author
10/26/2009	1.0	Initial Version	Paul Muzzey
11/24/2009	1.1	Revised Version to Address NHDOT and HNTB Comments	Paul Muzzey
02/15/2010	1.2	Revised Version to Address NHDOT Comments	Paul Muzzey
02/23/2010	1.3	Revised Version to Address NHDOT Comments	Paul Muzzey
03/05/2010	2.0	Revised for final NHDOT comments	Paul Muzzey
09/08/2010	2.1	Final Version prepared for signature	Paul Muzzey
12/06/2010	2.2	Modified BR C-3 to include height in 2-axle vehicle dual tire determination	Paul Muzzey

Table 1: Record of Changes

1. LIST OF ACRONYMS

Acronyms	Definition
ACS	Affiliated Computer Services
AVI	Automatic Vehicle Identification
AVC	Automatic Vehicle Classification
ETC	Electronic Toll Collection
FTP	File Transfer Protocol
GZIP	GNU Zip
IAG	Interagency Group (E-ZPass)
ICD	Interface Control Document
ICS	Image Capture Station
NHDOT	New Hampshire Department of Transportation
JOM	John O Morton Building
JPEG	Joint Photographic Experts Group
OCR	Optical Character Recognition
ORT	Open Road Tolling
TRMI	The Revenue Markets Incorporated
VES	Violation Enforcement System
VPC	Violation Processing Center

2. TABLE OF ORT BUSINESS RULES

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Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
Z-1	Zone	Generate a transaction for every vehicle in a travel lane or straddling lanes	Each vehicle traveling thru an ORT travel lane will generate "one and only one unique" transaction which will include – date/time stamp (from exit loop or scanner), transponder class, transponder ID, IAG class, transponder status, or violation, degradation code, straddle flag, axles, dual tire (y/n), AVC class, location, speed.	Reportable	Fixed
Z-2	Zone	Generate a transaction for every vehicle in a shoulder lane	Each vehicle traveling thru an ORT shoulder lane will generate "one and only one unique" transaction which will include – date/time stamp (from exit loop or scanner), transponder class, transponder ID, IAG class, transponder status, or violation, degradation code, straddle flag, location, speed. All shoulder events will assign AVC class 1.	Reportable	Fixed
Z-3	Zone	Lane assignment for straddle events	All straddle events will be assigned into a travel or shoulder lane based on IDRIS primary lane assignment.	Event flag - 11	Fixed
Z-4	Zone	Lane assignment during AVC (Idris) failure	All transponder events will be assigned into a travel lane or shoulder based on reported antenna read location and loop information. All violation events will be assigned by loops and overhead scanner and images	Event flag - 8	Fixed

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
			will be retained.		
Z-5	Zone	Lane assignment during AVC (Idris) failure and straddle antenna read	All transponder events will be assigned into a travel lane or shoulder based on reported straddle antenna read location and loop information. All violation events will be assigned by loops and overhead scanner and images will be retained.	Event flag - 8	Fixed
Z-6	Zone	Sensor data reported out of sequence or partial transaction information in queue	All data and events reported will be stored in ROMS and reported.	Reportable Note: Sensor refers to the loops, scanner, tag reader and camera systems in the zones	TC Configurable
Z-7	Zone	Buffered transponder reads reported from reader	All data and events reported, stored in database, alerted in ROMS and flagged.	Event flag - 1 Note: Not sent to TRMI	TC Configurable
Z-8	Zone	Excessive violations	The system will generate an alert message through ROMS after [10] consecutive violations or 100% violations within [1 hour].	Reportable	TC Configurable
Z-9	Zone	Buffer transaction data and images during network or system outages	In case of network or system outages, transaction data and images will be buffered for delivery until issue can be resolved.	Note: Retention Sizes are: Zone = min. 30 days ICS = min. 10 days	Fixed (hardware limitation)

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
H-1	Host	Lane assignment for shoulder transactions	All shoulder transactions will be reported as a shoulder transaction on the ORT Host and will be assigned into the most immediate adjacent travel lane when reported to TRMI.		TC Configurable
H-2	Host	Transmission of transactions (files) from ORT Host	Except for situations when network or system outages occur, transaction files will be created and forwarded for pickup by TRMI at least once an hour.		TC Configurable
H-3	Host	Transactions (files) from ORT Host	Each transaction file will contain "one and only one unique" serial number for each unique transaction and each unique transaction will have one and only one entry in the TRMI file.	Note: TRMI will assign a new serial number when forwarded to ACS	Fixed
H-4	Host	Status of transaction transmission	Each transaction will be flagged once it has been sent from the Host to TRMI	Event flag - Host	Fixed
H-5	Host	Violation capture image naming convention	Violation transaction images sent to ACS will be named in accordance with the ICD. ORT Host will maintain an internal naming convention.	Note: See ICD for image naming convention.	TC Configurable
H-6	Host	Violation image storage requirements	All retained images will be stored on the VES server for 30 days and then deleted.		Fixed (hardware limitation)
H-7	Host	Release of stored images and videos	No images or video will be released without a NHDOT directive and approval in accordance with State laws.		n/a
H-8	Host	Transmission of vehicle license plate	Violation images will be moved to ACS FTP	Note: Only Type I violations.	TC Configurable

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
		images for violation transactions per ICD	on a continual basis in near real time, not longer than within 1 day, unless there is a network outage.		
H-9	Host	Maintenance of fare schedule	Toll rates will be based on vehicle class, agency discounts and will have an effective date/time.		NHDOT Configurable
H-10	Host	No fare schedule is effective	A ROMS alert will be generated.	Reportable	TC Configurable
H-11	Host	Revenue Day	Revenue day is defined as 11:45:00pm to 11:45:00pm		TC Configurable
H-12	Host	ORT Special Event Mode Note: Must be approved by NHDOT per Work Instruction #TURN-Toll-014	While in this mode, all transactions will not be forwarded to TRMI and all captured images will not be forwarded to ACS. The Host will assign a $0.00 fare to all vehicle passages. All other typical transaction details will be recorded while in this mode will be reportable.	Event flag - Host	TC Configurable

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
A-1	AVI	Multiple transponders in a vehicle	All transponder reads from a single vehicle event will be reported with highest assignment read (provided by Mark IV) designated primary payment. If primary transponder is invalid the secondary transponder will be processed.	Event flag - 3	TC Configurable
A-2	AVI	Non-IAG transponder reported	The transaction will be reported as a violation, the non-IAG transponder ID will be stored, and the event will be flagged.	Event flag – 6	TC Configurable
A-3	AVI	Transponder read reports invalid IAG class code	All invalid IAG class codes reported will be assigned AVI class 1. The transactions will be reported to TRMI and alerted through ROMS.		TC Configurable
A-4	AVI	Transponder reported during a reverse vehicle event	The transaction will be reported as a reverse axle event and the event will be reportable.	Reportable	TC Configurable

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
V-1	VES	Vehicle license plate image taken for violation transactions	License plate images for violations will be defined as follows: Type I – non-payment (invalid or lost/stolen transponder or no transponder); Type II – class mismatch (between transponder class and AVC class); Type II – speeding (>X mph)	Event flag - 7	TC Configurable
V-2	VES	Retention of vehicle license plate images taken	Save for license plate images taken will be based on user defined retention setting: - Type I violation images only [default]; - Type II violation images only; - Speeding events; - All violation images (Type I and Type II); - All transactions	Note: Selected through ROMS	NHDOT Configurable
V-3	VES	Vehicle license plate image taken	All vehicle transactions will have front and rear license plate images taken; save will be based on retention setting.		Fixed
V-4	VES	Vehicle license plate image taken when AVC (Idris) is not operational	Both front and rear license plate images will be taken for all vehicles using loop I/O and overhead scanner, save will be based on retention setting.	Reportable	Fixed
V-5	VES	Vehicle license plate image taken during severe or inclement weather	License plate images taken during severe or inclement weather affecting visibility by human eye will continue to be saved based on retention setting and forwarded for		Fixed

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
			processing (note: due to weather conditions, these will be removed from performance sampling).		

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
I-1	ICS	Vehicle license plate image taken with no valid transponder	Both front and rear license plate images will be taken and saved per retention setting and forwarded to ACS per ICD for all vehicle events with invalid transponder, lost/stolen transponder, or no transponder.	Event flag - 7	Fixed
I-2	ICS	Vehicle license plate image taken for class mismatch	Both front and rear license plate images will be taken for all vehicle events where there is a class mismatch between the transponder class and AVC and saved per retention setting.	Event flag - 4	Fixed
I-3	ICS	Vehicle license plate image taken for vehicle traveling above speed threshold	Both front and rear license plate images will be taken for all vehicle events where their speed exceeds threshold mph value and saved per retention setting.	Reportable Note: Speed threshold is NHDOT configurable by authorized users.	TC Configurable
I-4	ICS	Loss of communication with zone controller	Both front and rear license plate images will be taken for every vehicle and saved per retention setting.	Reportable	Fixed
I-5	ICS	Vehicle license plate image quality	License plate images taken are automatically evaluated for contrast and brightness and will generate a ROMS alarm for values out of range.	Note: Quality process also selects best front image to forward to ACS	Fixed

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
C-1	AVC	AVC system data collection	The AVC will detect and report number of axles, dual tires, average vehicle height, width and length.		Fixed
C-2	AVC	AVC class assignment (determined based on axles and single or dual rear tires)	Vehicle class will be assigned as follows: 2 axles, SRT = class 1 3 axles, SRT = class 2 4 axles, SRT = class 3 5 axles, SRT = class 4 2 axles, DT = class 5 3 axles, DT = class 6 4 axles, DT = class 7 5 axles, DT = class 8 6 axles, DT = class 9 7 axles, DT = class 10 8 axles, DT = class 11 9 axles, DT = class 12 Note: SRT is single rear tires, DT is dual rear tires		TC Configurable
C-3	AVC	AVC dual tire (DT) detection	Idris axle loops will report dual tires (DT). All 2-axle vehicle events reported by Idris as DT with a vehicle height below 9'-0" will be down adjusted and reported as single rear tire class. All 2-axle vehicle events reported by Idris as DT with a vehicle height equal to or above 9'-0" will be reported as dual tire class. All vehicle events with greater than 2-axles will report Idris DT determination exclusively (i.e. height is not considered).		TC Configurable
C-4	AVC	AVC unusual axle data - low	Transactions with a reverse axle(s), 0 or 1 axle will default to class 1, will be reportable and all	Reportable	TC Configurable

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
			information will be retained.		
C-5	AVC	AVC unusual axle data - high	Transactions with an axle count of 10 axles or greater will default to class 1. All will be reportable and all information will be retained.	Reportable	TC Configurable
C-6	AVC	A reverse vehicle is detected in the zone	The transaction will be reported as a reverse axle event and will be reportable.	Reportable	TC Configurable
C-7	AVC	Reverse axles are detected in the zone prior to a completing the transaction event	The transaction will be reported, vehicle classification will be based in the net axle count and the event will be reportable.	Reportable	TC Configurable
C-8	AVC	AVC for shoulder transactions	All shoulder transaction events will be assigned AVC class 1.	Reportable	TC Configurable
C-9	AVC	AVC system degraded or failed - Idris	If Idris is unavailable, vehicle loop tracking, lane assignment and all transponder reads will be reported and all license plate images will be retained. All data will be flagged with date/ time of occurrence, location, and all events will report as class 1 with a degraded AVC flag.	Event flag - 8 Note: Transactions will be forwarded to TRMI with degrade code 99	Fixed
C-10	AVC	AVC system degraded or failed - loops	If the loops are unavailable, all transponder reads will be reported and all rear license plate images will be retained. Lane assignment will be based on the reader reported antenna location. All data will be flagged with date/ time of occurrence, location, and all	Event flag - 8 Note: Transactions will be forwarded to TRMI with degrade code 99	Fixed

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
			events will report AVC class 1 with a degraded AVC flag.		
C-11	AVC	Overhead scanner is degraded or failed	If overhead scanner is unavailable, Idris will be the sole determinant of axle count and dual tire detection and will determine vehicle class. Events will be flagged with date/ time of occurrence, location, and scanner degraded flag.	Event flag - 8	Fixed
C-12	AVC	Complete AVC system failure	If the AVC system is not operational and a transponder class is reported, the AVC class will be 1.	Event flag – 8 Note: Transactions will be forwarded to TRMI with degrade code 99	TC Configurable

Rule	Level/ Subsystem	Issue	Business Rule	Comment[1]	Config Type[2]
O-1	ORT	Definition of non-standard operating conditions	Event flags will be a value that associates unusual events, degraded conditions, or non-standard modes as defined herein.	Event flag codes in zone controller can be seen in the table at the end of this document[3].	TC Configurable
O-2	ORT	Notification of communication outages: Zone(s) and Host, or Host and external interfaces	The ORT Toll System will alarm through ROMS when outages occur.		TC Configurable
O-3	ORT	Local storage during communication outages: Zone(s) and Host, or Host and external interfaces	Zone controllers will maintain transaction data for a minimum of 30 days; ICS will maintain images for a minimum of 10 days; Host will maintain all data in detail for 2 fiscal years plus the current fiscal year before summation and archive.		Fixed (hardware limitation)
O-4	ORT	Manual file processing: transponder status files, transaction files, image files	If a network outage exists, manual uploads/ downloads will be scheduled at the following intervals: Uploads: Transactions (Daily) and Images (Daily) Downloads: Tag Status File (Daily)		n/a

Notes:

1 – Comment:

Reportable – The transaction contains unique data that eliminates the need for an event flag and is reportable from the database. Typically these transactions do not apply post processing rules.

Event Flag – Based on elements of the transaction, an event flag is set and associated with the information. Typically these transactions do apply post processing rules.

2 – Configuration Type:

Fixed – System designed to meet functional requirement, requires change order to modify;

TC Configurable – A rules based software code change modified by Telvent Caseta included under the maintenance contract;

NHDOT Configurable – Can be changed by NHDOT users through designed application GUI.

3 – Event Flags:

Below are the event flag descriptions in the zone controller:

Ref	Flag	Values	Description
1	TrxFlag	B, N, S	Describes the transaction as Buffered, Normal, or Spurious Tag (1)
2	DualTireFlag	Y/N	Yes if vehicle has dual tire detected
3	AddTag	Y/N	Yes if vehicle has multiple tags associated with it
4	ClassConflict	Y/N	Yes if the AVC and tag classes don't match
5	InvalidTag	Y/N	Yes if the prime detected tag is invalid (lost, stolen, inactive, invalid)
6	UnknownTag	Y/N	Yes if the prime detected tag is not known to the system.
7	Violation	Y/N	Yes if the vehicle has insufficient payment and/or a class mismatch.
8	AVCNotOper	Y/N	Yes if any component within the AVC subsystem is not operational during the time of this transaction.
9	VESNotOper	Y/N	Yes if any component within the violation enforcement system (e.g. cameras, ICS) is not operational during this transaction.
10	InsuffPayment	Y/N	Yes if this vehicle does not have payment associated with it.
11	Straddle	Y/N	Yes if this vehicle is determined to be straddling another lane (e.g. traveling partially in a lane besides the lane the transaction is attributed to; "white-lining".)

Notes:

(1) – Buffered means the transaction was received non real-time; normal means the transaction was received in real-time; spurious means the transaction was received with a tag read and no vehicle data.

New Hampshire DOT

TELVENT
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SIGNATURE PAGE

By NHDOT:

Signature

John Corcoran Jr

Name

Project Manager - Assistant Administrator

Title

12/13/10

Date

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12/08/10

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